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The Potency of Ammonia from Broiler's Manure Based on Age Phase of Ration Administration on Closed House and Open House

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ABSTRACT

The aim of this research was to evaluate the potency of ammonia production from broiler's manure based on the age phase of ration administration on the closed and open house cage. This research used Completely Randomized Design in Factorial 3x 2 with the first factor was three age phase of rations administration (0-10 days old, 11-21 days old and 22-32 days old) with three replications of each age phases. The second factor was the type of cage system (closed and open house) with two cages of each cage type. The variable observed was the ammonia concentration from broiler's manure. The Data were analyzed for their variance by Analyzes of Variance (Anova). The detailed test used Duncan Multiple Range Test. The result of this research showed that the age phases of ration administration increased the manure ammonia concentration ($P<0.05$). The older of age phase increased the ammonia concentration. The cage system had significant effect to ammonia concentration. The closed house system produced the ammonia concentration higher than open house cage. The technology that was used in closed house system had a positive effect to ammonia mitigation.

Keywords: Ammonia, age, cage, manure

INTRODUCTION

The consumen demand to poultry meat triggered the population of broilers in Indonesia one of them is in Bengkulu Province. The increasing of broiler population had a positive impact to the availability of broiler meat in Bengkulu, but also gave a negative impact to the broiler, man, and environment. This is because the odour and the harmful effect from ammonia (NH_3). Patterson and Adrizal (2005) said that ammonia decreased the performance and the productivity of broiler such as decreased the growth rate and feed conversion and emerge the respiratory tract diseases. Ammonia is the air pollutant that also be produced from farm business whom animal were the largest contributor of ammonia emission (Aneja et al., 2006). Ammonia odour is main source triggered public anxiety. This is because the poor of poultry management. The harmful effect from ammonia emission to environment take effect to broiler performance and the human soundness. The ability of NH_3 reacted with acid compound in the air enhanced the aerosol caused acid rain and it was very dangerous to human health.

The negative impact of ammonia to environment came from the livestock manure production (Yuwono et al., 2021). The main source of stink odour was from poultry daily manure production that increased every day. The production of manure for each broiler up to harvest were 0,5-0,8 kg/bird. The manure that was produced from the broiler increased every day along with the age. The residential area around the poultry farm is getting denser. The space of residential area to poultry farm are 50 m-350m. This space is very close to be affected by air pollution from the chicken manure and by the direction of the wind. The wind could bring the ammonia odour to the residential area. The farms should be established far from the residential area because it was safe from air pollution. The growth of human population increased the residential area which in the end the residential moved closer to chicken farms.

Ammonia were poisonous, could give rise to chicken mortality score on 30 days old until 40 days old (Brigden and Stringer, 2000). The high mortality score was triggered by the high intensity of odour from under cage (open house cage) with the mean height from the land surface 140 cm until 150 cm. Ammonia (NH_3) or chicken manure under the cage will be smelled directly by the chicken. This will impact to the respiratory problem that can make the chicken growth were far from ideal. The ammonia controlling in poultry farms are important to ensure NH_3 reduction and to create the farm environment healthier. The broiler

rearing cage now used the open cage (open house) and closed house. The cage is one of determinant success factors in raising the broiler, especially with the temperature in Indonesia which are not suitable for broiler growth. The broiler can grow optimally on the temperature range 19-21^{o}C, so that it needed the cage/house.

The type of broiler cage based on the wall (ventilation) can be distinguished into open and closed house. The open house has the open wall made from wood or bamboo, while the closed house has the closed wall made from permanent materials used the high technology, so that the closed house had a good ventilation that can reduce the impact of the high air humidity. Ritz et al. (2014) said that the temperature, humidity, and the air velocity with the ventilation in cage has a big effect to ammonia concentration in cage.

The aim of this research was to evaluate the potential production of ammonia that were produced by broiler farm based on age phase from the closed and open house.

MATERIALS AND METHOD

This research was done on the broiler farms at Bengkulu Tengah district for open house cage and Kelurahan Betungan Bengkulu City for closed house cage. The population of broiler were about 4500 up to 7000 heads. The strain of broilers was Cobb. The size of open house cages was 8 m x 80 m and for closed house cages were 10 m x 100 m. The feed where three types of commercial concentrate were given: a. SB 10 Super (It is for pre starter periode: age 0-10 days old), b. SB 11 Super (for starter periode: age 11-21 days old), and c. SB 12 Super (for finisher periode: age 22-32 days old). The nutrient content (crude protein, Metabolisable energy, calcium, and phosphor) of each concentrate were 21-22%crude protein, 3035 kcal/kg, Calcium 0.9%, Phospor 0.45 % for SB 10 Super, 19-20% crude protein, 3108 kcal/kg, Calcium 0.84%, Phospor 0.42% for SB 11 Super, 18-19crude protein, 3180 kcal/kg, 0.76%calcium, 0.38% phosphor for SB12 Super.

The data were the concentration of NH_3-N manure based on their age phase from closed house and open house. The concentration of NH_3-N was analysed by using the microdiffusion Conway technique (General Laboratory Procedures, 1966). The design of research was Completely Randomized design in factorial 3 x 2 with the first factor were age phases of feeding (0-10 ten days old, 11-21 days old and 22-32 days old). The second factor was the types cage (closed and open house). There were four replications for the first factor respectively and two replications for the second factor (two cage for open house and closed house respectively). The condition of temperature and the humidity around the cages were also noted.

The analysis of variance (Anova) was used for the signicifancy and Duncan Mutiple Range test was used for detailed test (Steel and Torrie, 2003).

RESULT AND DISCUSSION

The result of this research showed that there was no interaction between the age phase of broiler and the type of cage to ammonia production (P>0.05). The anova test showed that the single factor consisted of the age phase of broiler and the type of cage had a significant effect (P<0.05) to ammonia concentration respectively. The effect of age phase of broiler to the concentration of ammonia is presented in Tabel 1.

Tabel 1. The effect of age phase of broiler to ammonia concentration in manure

Age of broiler (day)	Ammonia Concentration (ppm)
0-11	24,88^{b}
11-21	41,45^{a}
>21	47,37^{a}

Note: The numbers that were followed the same word in the same column meaned significant effect (P>0.05)

The result showed that the age phase of broiler had a significant effect to ammonia concentration in manure. The older of broiler's age produced the concentration of ammonia in the manure were higher than the normal standard. The concentration of ammonia on 0-11 days old were 24,88 ppm lower than 11-21 days old which were 41,45 ppm. The safe concentration of ammonia was around 3-5 ppm. On the concentration 11 up to 30 ppm could decrease the productivity and could infect the respiratory tract and more than 30 ppm can swell fabricious bursal to death (Pauzenga, 1991). The concentration of ammonia more than 5 ppm had a negative impact to the poultry growth and caused health problem to broiler, the worker, and the community around the farm (Justiani, 2021).

The type of cages had a significant effect to ammonia concentration in manure. The closed house system produced ammonia concentration higher than open house system (P<0.05) (Table 2.)

Tabel 2. The effect of broiler cage type to ammonia concentration in manure

Type of cage	Ammonia concentration (ppm)
Closed house	42,30 [a]
Open House	33,51[b]

Note: The numbers that were followed the same word in the same column meaned significant effect (P>0.05).

Sousa *et al.* (2018) said that 25 ppm was the highest score of ammonia concentration. More than 25 ppm can cause irritation, respiratory tract problem and other negative effects. In this research, closed house system produced ammonia higher than open house because the litter in closed house had been mixed with excreta. The ammonia in excreta increased the ammonia in the litter. Maliselo and Mwaanga (2016) reported that the concentration of ammonia in the litter was affected by nitrogen in excreta.

The type of cage had a significant effect to ammonia concentration in manure. The manure in closed house had higher concentration of ammonia than open house cage (P<0.05). But the odour of ammonia from open house cage had stronger scent than closed house. This condition occured because the excreta often mixed with the feed and drinking water so induced the odour in open house cage. William and Meijerhof (1990) reported that the high humidity in the cage made the ammonia in cage evaporate faster so the concentration of ammonia became high in the air. There was no strong ammonia odour in closed house cage. The principal of closed house was to provide healthy air, build the cage with healthy air using good ventilation. The productivity of broiler is optimal because the closed house system is designed by using technology so it can serve the comfortable temperature for broiler (Alimuddin et al., 2011). The temperature of cage was maintained around 18^{o}C-22^{o}C that the ideal temperature for broiler (Charles 2000).

The closed house cages were in densely populated residential, but the nobody was protest. It supposed because no scent odour that escape from the farm. The ammonia odour from the broiler's open house cages was the anxiety trigger for the social environment around the farms. So that it must be search the location far from the residential for the open house cages. The location for closed house can be near with the residential by paying attention the farm management and sanitation.

Tabel 3. The mean microclimate (temperature and humidity) around the cages

Type of cage	Temperature (^{o}C)	Humidity (%)
Closed house	30,83	72%
Open house	30,83	72%

The mean of temperature and humidity at the time of research is presented in Table 3. Indonesia has a tropical climate with high temperature and humidity. This condition has an impact to ammonia production. Lima *et al.* (2011) said that the microclimatic element in the cages such as temperature, humidity, and air velocity influenced the increasing production of ammonia in cages.

The air humidity can influence the gas emission produced from the broiler's manure. The higher is humidity in the cages, the micro-organisms can grow well such as the ureolitic bacteria. The ureolitic bacteria produced urease that can break uric acid into ammonia (Rothrock et al., 2008).

In closed house cage, the odour which were produced from feces were not stinging. With the modern technology, the external environtment does not affect the climate in the closed house cage. Closed house cage can reach the comfortable environment for broiler.

AUTHORS' CONTRIBUTIONS

This research reported that the age phase of broiler had a significant effect to the concentration of ammonia in manure. The concentration of ammonia in manure was higher in closed house cage. By a touch of technology, ammonia mitigation in closed housed were better so that it can minimized the negative effect to environment.

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